ABSTRACT

We propose to measure the p(e,e′p)η reaction in the region near-threshold. The purpose of these proposed measurements is to obtain high precision, accurate data in the region near threshold. These data will allow a multipole analysis which will adequately constrain models of the eta electro-production process, which is dominated by the excitation of the $S_{11}(1535)$ resonance. The $S_{11}(1535)$ is interesting from the points of view that it has an anomalously flat form-factor, and is the only resonance in this energy region with any appreciable coupling to the ηN channel. However, the possibility of contributions from the $P_{11}(1440)$ and $D_{13}(1520)$ resonances, as well as s-, p-, and d-wave non-resonant Born terms, also exists. Present data do not allow separation of any of these small contributions. We propose to obtain full eta angular distributions in the center-of-mass system, as a function of excitation energy up to approximately 20 MeV above threshold, with very good energy and angular resolutions, and very good statistical precision. Measurements will be made at Q^2 values of 3.0 and 4.0 $(GeV/c)^2$, and at a Q^2 of 0.65 $(GeV/c)^2$ where we will also perform a Rosenbluth separation to individually determine the longitudinal and transverse contributions for the first 4 MeV above threshold. These measurements will provide accurate data of the angular distributions as a function of energy to allow separation of any small contributions to the form-factor from the non-dominant terms. Thus, it will provide new information on the $S_{11}(1535)$ with unprecedented energy resolution. By staying at energies near the eta-production threshold (up to approximately +20 MeV), we will exploit the fact that the emitted protons are "kinematically focused" along the direction of the momentum transfer vector, thus allowing full use of the high resolution capabilities of the HRS spectrometers in Hall A.